**Must-Knows: Unit 3 (Cell Structure and Transport)**

Ms. Ottolini, AP Biology

**Test Format:** 30 multiple choice questions, 4 calculations questions (2 questions about water potential and 2 questions about surface area to volume ratios), and 2 short answer questions

***Objective #1:*** You will be able to describe the chemical composition of the cell membrane and discuss how the structure of the membrane relates to its selective permeability.

1. How do phospholipid molecules arrange themselves in the cell membrane? How does this give the cell membrane selective permeability?
2. What are the functions of membrane proteins?
3. What are the functions of carbohydrate chains on the outside surface of the cell membrane?

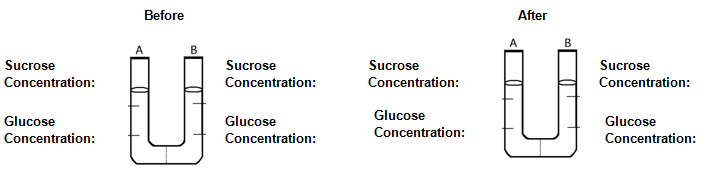
***Objective #2:*** You will be able to compare / contrast the main types of transport across the membrane – diffusion, osmosis, and active transport.

1. Which cells (smaller or larger cells) have higher surface area to volume ratios? Why is this significant?
2. Plant cells have a large central vacuole. How does this affect the surface area to volume ratio of the cell? (Hint: See the Unit 3, Part 2 Notes section on vacuoles)
3. The solutions in the two arms of this U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is half-filled with a solution of 4 *M* sucrose and 3 *M* glucose. Side B is half-filled with 2 *M* sucrose and 5 *M* glucose. Initially, the liquid levels on both sides are equal.

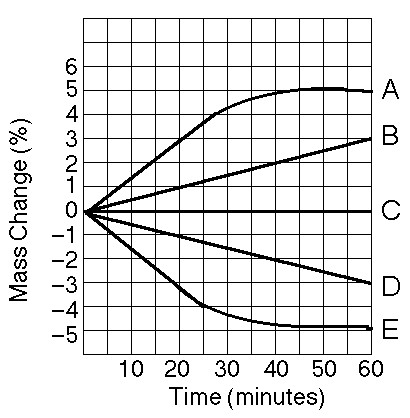
After the system reaches equilibrium, what changes are observed in side A? (Circle the correct term that completes the statement)

* The concentration of sucrose **increases / decreases / stays the same**
* The concentration of glucose **increases / decreases / stays the same**
* In response to the movement of solutes, the water level **increases / decreases / stays the same**

You may want to draw a sketch (see images below) to indicate solute concentrations in the “U-Tube” before and after movement of solutes across the membrane. You may also want to draw an arrow on your “after” picture to indicate the direction of water movement.



1. Five dialysis bags, constructed from a semipermeable membrane that is impermeable to sucrose, were filled with various concentrations of sucrose and then placed in separate beakers containing an initial concentration of 0.6 *M* sucrose solution. At 10-minute intervals, the bags were massed (weighed) and the percent change in mass of each bag was graphed.

* A positive percent change in the mass of the bag indicates that water has **entered / left** the bag.
* A negative percent change in the mass of the bag indicates that water has **entered / left** the bag.
* Bags A and B contain a solution that is **hypotonic / hypertonic / isotonic** to the outside solution
* Bag C contains a solution that is **hypotonic / hypertonic / isotonic** to the outside solution.
* Bags D and E contain a solution that is **hypotonic / hypertonic / isotonic** to the outside solution.
* Bag **A / E** has the highest initial concentration of sucrose.
* Bag **A / E** has the lowest initial concentration of sucrose.
* Bag **A / E** has the highest initial concentration of water.
* Bag **A / E** has the lowest initial concentration of water.

1. What kind of molecules pass through the cell membrane most easily? (small vs. large, nonpolar vs. polar or charged)
2. Complete each statement below with the term that describes the effect of water movement into and out of real plant and animal cells.

* When placed in hypotonic solution, a plant cell becomes **plasmolyzed / flaccid / turgid.**
* When placed in isotonic solution, a plant cell becomes **plasmolyzed / flaccid / turgid.**
* When placed in hypertonic solution, a plant cell becomes **plasmolyzed / flaccid / turgid.**
* When placed in hypotonic solution, an animal cell may **shrivel / lyse.**
* When placed in hypertonic solution, an animal cell may **shrivel / lyse.**

1. Cystic fibrosis is a recessively inherited disorder that results from a mutation in the gene encoding CFTR chloride ion channels located on the surface of many epithelial cells.

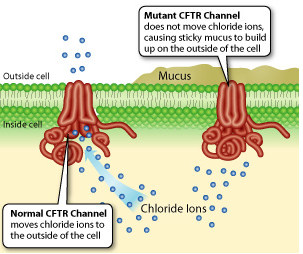
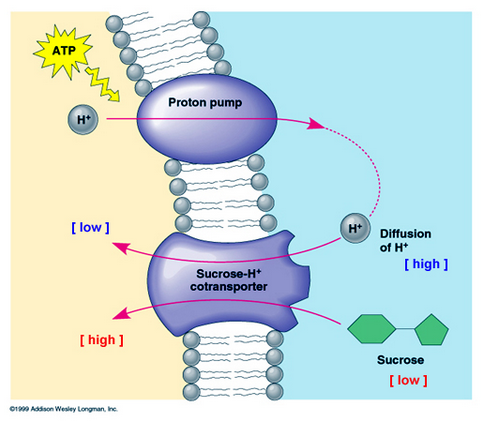


Image courtesy of: learngenetics.utah.edu

How does the CFTR channel’s inability to transport chloride ions from the inside of the cell to the extracellular fluid result in “dehydrated” mucus (i.e. mucus with a very low concentration of water).

***For #11-13, use the image to the right as a reference.***

1. Describe how sucrose is transported into the cell using the H+ / sucrose symporter.
2. What is a symporter? How is it different from an antiporter?
3. Is this a type of passive or active transport? How do you know?
4. Describe the difference between the three types of endocytosis—phagocytosis, pinocytosis, and receptor-mediated endocytosis. How is endocytosis different from exocytosis?

***Objective #3:*** You will be able to apply mathematics to predict a cell’s water potential and the efficiency of cell transport based on a cell’s surface area to volume ratio.

***\*\*\*For this section, please review your Water Potential Notes, the Osmosis and Water Potential Practice Worksheet, the Potato Cell Osmosis Challenge Problem, and the Surface Area to Volume Ratio Worksheet (aka the Cell Size Worksheet)\*\*\****

***Objective #4:*** You will be able to compare the structures found in various cell types and connect the function of a cell to its unique structural features.

1. A cell has the following molecules and structures: enzymes, DNA, ribosomes, plasma membrane, and mitochondria. It could be from… (circle all that apply)

**A bacterium, a plant, an animal**

1. What structures in the cell contain DNA?
2. What cell structures are found in prokaryotic cells? (Hint: there is a picture of a prokaryotic cell in your Unit 3, Part 2 Notes)
3. Why is it important to have different compartments in the cell (separated by membranes) with different environments (ex: different pH’s, different enzymes present, etc)?
4. Discuss the pathway that secretory proteins (proteins destined to leave the cell) take through the endomembrane system starting with their synthesis and ending with their secretion from the cell.
5. Cells with a large amount of Rough ER might be specialized for which function?

Cells with a large amount of Smooth ER might be specialized for which function?

Cells with many lysosomes might be specialized for which function?

Cells with many vacuoles might be specialized for which function?

Cells with many mitochondria might be specialized for which function?

Cells with many chloroplasts might be specialized for which function?

Cells with cilia and flagella might be specialized for which function?

Cells with many ribosomes might be specialized for which function?

Cells with cell walls but no other organelles (i.e. dead cells, like some found inside the trunks of trees) might be specialized for which function?

1. In what organelles are microtubule proteins used?
2. How are plasmodesmata in plant cells and gap junctions in animal cells similar? What are they used for? How are animal cell tight junctions and desmosomes (aka adhesion junctions) different?
3. Where are proteins produced in free ribosomes (aka cytoplasmic ribosomes) used in the cell? What is an example of a protein produced in a free ribosome?
4. Where are proteins produced in bound / attached ribosomes (aka Rough ER ribosomes) used in the cell? What is an example of a protein produced in a bound ribosome?